Carcinogenicity of Diesel Exhaust Particulates

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Classifications of Diesel Engine Emissions

- NTP - Reasonably anticipated to be a human carcinogen
- IARC - Probably carcinogenic to humans
- EPA - Likely to be carcinogenic to humans
- State of California - Toxic air contaminant based on potential to cause cancer
- ACGIH and NIOSH - Similar notations

National Toxicology Program

- Reasonably anticipated to be a human carcinogen
  - Based on higher lung cancer rates among exposed workers
  - Supporting evidence from animal studies and mechanistic data
    - Lung cancer in rats
    - DNA adducts in rat lung cells

International Agency for Research on Cancer

- Diesel Engine Exhaust
- Probably carcinogenic to humans
- Animal study data
  - Inhalation exposure to whole exhaust
  - Inhalation of particulates and lung cancer in rats
  - Exposure to particle extracts
- Human study data
  - Railroad workers and lung cancer
    - Risk increased with greater exposure

Environmental Protection Agency

- 2000 Health Assessment Document (HAD) for Diesel Exhaust
  - Likely to be human carcinogen
    - Inhalation at occupational and environmental levels of exposure.
- Clean Air Scientific Advisory Committee Review of HAD
  - EPA's conclusion is scientifically sound.

EPA

- 30 Epidemiological studies demonstrate increased lung cancer risk in diesel exhaust exposed humans.
  - Increased risk ranged from 20 to 167% in the most relevant studies.
  - Pooling data from many studies suggests risks increased 33 to 47%.
- Supported by animal and mechanistic studies.

State of California

- Listed as a Toxic Air Contaminant based on carcinogenicity and other non-cancer health effects.
  - Reviewed over 30 human epidemiological studies.
  - Average of a 40% increase in lung cancer risk
- Inhalation studies in rats demonstrate carcinogenicity
- Mutagenicity indicated by various studies.

Other Agencies Recognize Carcinogenicity

- American Conference of Governmental Industrial Hygienists
  - Diesel exhaust, particulate on Notice of Intended Changes (for 2000)
    - Basis of Cancer
- National Institute of Occupational Safety and Health
  - Potential Occupational Carcinogen

Diesel Engine Exhaust Cancer Risk

- EPA - Insufficient data to develop a confident estimate of cancer potency.
  - Conclude that a range of risk is possible
  - Risk associated with environmental exposures range from 1 in 100,000 to 1 in 1,000.
  - Risk might also be zero.

Diesel Engine Cancer Potency

- California has developed a cancer potency value.
- Based on epidemiological studies
  - Range of values 1.3×10^{-4} to 2.4×10^{-3} $(g/m^3)^{-1}$
  - Using two separate approaches, concluded 3×10^{-4} $(g/m^3)^{-1}$ is reasonable.
  - Did not identify a threshold.

Conclusion

- Diesel engine exhaust, in particular particulates, are classified as carcinogenic by NTP, IARC, EPA, California, and other organizations.
- Based on epidemiological, animal, and mechanistic studies.
- EPA has suggested a range of cancer risk.
- California has derived cancer potency values.